



SONDERKOLLOQUIUM

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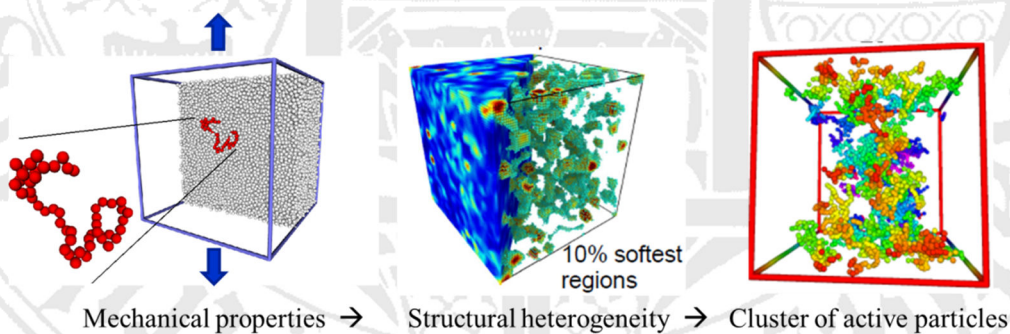
IM HÖRSAAL II IM PHYSIKHOCHHAUS

Plasticity in polymers and other amorphous materials

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Polymer glasses are paradigmatic non-equilibrium disordered systems. Their nonlinear mechanical response exhibits many surprising phenomena such as memory, structural recovery, hysteresis and rejuvenation, whose origins need to be understood on the molecular level. We use molecular simulations of model polymers to gain access to dynamics at temperatures not too far below the glass transition, where thermal processes compete with external driving. Amorphous materials display structural heterogeneity at the nanoscale, and we show how the vibrational spectrum controls local relaxation events. An analysis of the distribution of relaxation times reveals the origin of physical aging and can be used to predict averaged segmental motion with random walk models. Our studies furthermore reveal how active deformation accelerates the dynamics as observed in recent experiments that directly measure molecular mobility in polymer glasses.



In the final part of the talk, we focus on plasticity mechanisms in the low temperature regime representative of soft glasses such as foams, emulsions, and dense colloidal suspensions. Here, swift localised particle rearrangements take place in the midst of a more or less homogeneously deforming medium. At low temperatures, failure events become increasingly correlated and develop self-similar properties that resemble critical phenomena. We show that the long ranged elastic interactions between plastic events can be well described with continuum elasticity theory, and show how to develop a mesoscopic model of plastic flow as a stepping stone towards a comprehensive theory of amorphous plasticity.